NETLAKE SYMPOSIUM

Gaming, Lunz, Austria

4th July, 2016

Monday 4th July & Tuesday 5th July, Gaming, Lunz, Austria

4th July 11.00-12.00	4th July 13.00-17.30	4th July 19.30	5th July 9.00-17.00
Management Committee meeting Library	Final Symposium Library	Final NETLAKE dinner	NETLAKE working group sessions and GLEON Day 1

Networking Lake Observatories in Europe

NETLAKE Final symposium

Monday 4th July 2016, Kartause Gaming, Lunz, Austria

Library		
13.00-13.20	**Welcome: Martin Kainz, Eleanor Jennings, Kathie Weathers**	
	Networking Lake Observatories in Europe: an overview	Eleanor Jennings
	NETLAKE: our outputs and deliverables	
13.20-13.40	Towards a world-wide metadatabase for high frequency lake data	Elvira de Eyto
13.40-14.00	Factsheets for limnologists: how to do all the things you ever wanted to with high frequency lake data.	Biel Obrador
14.00-14.20	Engaging European citizens in lake science: the NETLAKE survey and citizen science project.	Laura Seelan
14.20-14.40	Using high frequency monitoring data for managing lakes and reservoirs across Europe	Rafa Marce
14.40-15.00	***Coffee break***	
	Informing management of lakes in Europe	
15.00-15.20	Informing high frequency dissolved organic carbon monitoring in lakes	Liz Ryder
15.20-15.40	What can high frequency measurements tell us about mixing events in lakes?	Ian Jones
15.40-15.00	A European Multi-Lake Survey of Phytoplankton and Cyanobacterial Blooms	Evi Mantzouki
	Initiatives linked to NETLAKE	
16.00-16.15	Lake Heat Flux Analyzer: a program to calculate surface energy fluxes in lakes.	Iestyn Woolway
16.15-16.30	Using high frequency monitoring to manage fishponds in Czechia	Katerina Sumberova
16.30-16.45	Assessing the impact of environmental variables together with a short extreme wind event on metabolism Lake Eymir using HF data	Meryem Beklioğlu
16.45-17.00	Into the future: the MANTEL MSCA Innovative Training Network and PROGNOS – a Water JPI project	Eleanor Jennings
17.00-17.15	Q and A	
17.15	Symposium close: Dr Mafalda Quintas (COST Association, Brussels)	
17.30	***Final NETLAKE photo***	
18.00-19.30	***Mixer and introduction to GLEON***	***Monastery pub***
19.30	***Final NETLAKE diner***	***Restaurant***

Networking Lake Observatories in Europe: an overview

Eleanor Jennings[1] , Elvira de Eyto[2], Giovanna Flaim[3], D. Glen George[4], Bastiaan Ibelings[5], Ian Jones[6,] Alo Laas[7], Rafael Marce[8], Stephen Maberly[6], Biel Obrador[9], Don Pierson[10], Lisette de Senerpont Domis[11-12], Peter Staehr[13] and all NETLAKE participants

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Abstract

The successful establishment of the NETLAKE community addressed the overarching aim of COST Action ES1201: to build a network of sites and individuals to support the development and deployment of sensor-based systems in lakes and reservoirs across Europe. This is now leading to new and dynamic collaborations within Europe, and indeed globally through GLEON and other global networks. NETLAKE has built capacity in all its member countries by strengthening links between existing collaborators, and facilitating communications between scientists and citizens' groups, water managers, and small medium enterprises. The NETLAKE meetings, training schools, and the STSMs in particular, have been the backbone of this work, focused on using high frequency monitoring (HFM) data from lakes and reservoirs to produce high quality science outputs. Through the four science Working Groups (WGs), the Action has also launched a metadatabase of sites with HFM platforms (WG1), published a set of best practice guidelines on the practicalities of deploying and maintaining automatic stations on lakes and reservoirs (WG1), developed a set of factsheets on data analysis tools (WG2), developed and launched a cross-European citizen science project on decomposition and on micro-plastics in lakes (WG3), and worked closely with managers on a set of management related case studies (WG4). It has also produced a review of the use of HFM for the management of lakes and reservoirs (WG4), while, in addition eight papers linked to NETLAKE have been published, four other submitted and seven are in preparation through both WGs and STSMs. Two large-scale EU level projects involving NETLAKE partnerships have now been awarded, while fifteen projects linked to NETLAKE have been funded at national level. Monitoring systems have also been deployed at eight new sites across Europe. The extent of this collaborative work, which has involved a community of over 100 participants in 26 countries, has ensured a strong foundation for the network into the future.

Eleanor Jennings is Chair of the NETLAKE COST Action, and director of the Centre for Freshwater and Environmental Studies, DkIT, Ireland. Her current research interests include carbon and nutrient cycling, the effects of agriculture on water quality, and also hindcast and future climate modelling.

Towards a world-wide metadatabase for high frequency lake data

Elvira de Eyto[1]; Alo Laas[2]; Don Pierson[3]; Georgina Mirceva[4]; Andreja Naumoski[4]; Daniel Langenhaun[5]; Michael Healy[6]; Andrew Clarke[6]; Kari Astenes[7]; Eleanor Jennings[6]

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Abstract

One of the key deliverables of the COST action NETLAKE is to build a metadatabase which contains information about the sites in Europe where high resolution monitoring of lakes is being carried out. The intention is that this metadatabase will be used as a tool for scientists and water managers who require information about what, where, and how various lake monitoring parameters are being measured. It is also intended that this metadatabase will outlive the end of NETLAKE and serve as a tool for continued networking of lake observatories at a global scale, through its integration with GLEON. The metadatabase has been built using an open-source SQL program PostgreSQL and the database management tool *adminer.* A user friendly instruction manual for populating the database and a second manual for searching the records have been produced. Spatial interrogation of the data is possible through the open source QGIS platform. To date (June 2016), the metadatabase contains information from 68 sites, with information about 430 separate sensor measurements.

Elvira de Eyto has worked at the Marine Institute's research station in the Burrishoole catchment, Co. Mayo since 2003. The main focus of her job is the long term ecological monitoring of the catchment, and provision of advice on diadromous fish to the MI's customers.

Factsheets for limnologists: how to do all the things you ever wanted to with high frequency lake data

Biel Obrador[1]; Ian Jones[2]; Rosana Aguilera[3]; Andersen, Mikkel[4]; Louise Bruce[5]; Jesper Christensen[4]; Raoul-Marie Couture[6]; Elvira de Eyto[7]; Marieke Frassl[8]; Mark Honti[9]; Rafael Marcé[3]; Dario Omanović[10]; Ilia Ostrovsky[11]; Don Pierson[12]; Ivanka Pižeta[10]; Friedrich Recknagel[13]; Peter A. Staehr[4]; Koji Tominaga[6]; Michael Weber[8]; R. Iestyn Woolway[14]; Eleanor Jennings[15]

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Abstract

The NETLAKE Toolbox is a compendium of short factsheets introducing different techniques and tools used in the processing, analysis and modelling of high-frequency monitoring (HFM) data. It was developed by the *Working Group on Data Analysis and Modelling Tools* of the NETLAKE Cost Action (*Networking Lake Observatories in Europe*). A survey within the NETLAKE community allowed the identification of a preliminary list of topics. The Toolbox currently consists of 12 factsheets on statistical techniques, numerical procedures to derive specific lake attributes, and available codes, packages or software useful for performing particular calculations and typical HFM data processing. The primary target audience for the Toolbox is researchers and managers familiar with HFM data but without previous experience in the particular topics addressed in each of the factsheets. The factsheets are neither specialised review papers nor synthetic textbooks. Their function is to give inexperienced users an introduction to a given technique, its fundamentals and what it is used for, taking advantage of the experience of specialised users through listed pitfalls and tips. The factsheets include lists of key scientific literature where the techniques are applied, robust textbooks where fundamentals are presented, and direct links to available codes, all supplied with the intention of helping inexperienced users get more easily into each of the topics addressed.

Biel Obrador, a lecturer at the University of Barcelona, is an ecosystem ecologist specialized in carbon cycling in aquatic systems. His research interests include lake metabolism, processing of dissolved organic and inorganic carbon, greenhouse gas fluxes and biogeochemical dynamics of the aquatic-terrestrial boundaries.

Netlake Working Group 3 – Citizen Science monitoring program

Laura Seelen[1-2], Giovanna Flaim[3], Eleanor Jennings[4] and Lisette de Senerpont Domis[1-2]

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Abstract

NETLAKE Working Group 3 focuses on the establishment of a Europe-wide citizen science initiative. We will report on our 2015/2016 initiative in which a Europeanwide Water Awareness survey was done and a citizen science monitoring program was launched across NETLAKE sites.

Our on-line survey was aimed at determining whether people from different demographic and geographical regions have different attitudes towards water usage, perceive water quality differently and are interested in monitoring and protecting local waters (n=498). Preliminary data suggest that the participants not only underestimated their direct, but even more their indirect water use. The results of the survey allow for more targeted water education and water awareness outreach. Additionally, the outcome of the survey allows us to further improve our strategy towards more effectively involving citizen scientists in lake sampling campaigns.

In our Citizen Science lake sampling campaign we will focus on two environmental challenges, carbon storage in aquatic systems, and pollution by microplastics. Motivated citizens collaborating with local scientists will address these challenges by placing temperature loggers, measuring Secchi depth and water colour, placing tea bags to assess decomposition rates and sampling for plastics using homemade sampling equipment. By actively involving citizens in the whole process of doing science, we not only are able to work with citizens as sensors, but also increase environmental and scientific literacy of local end users.

Laura Seelen is currently working to obtain her PhD in the ecosystem services of deep man-made lakes at the Netherlands Institute of Ecology. After two years of lake sampling with the help of enthusiastic volunteers in the Netherlands, she's now helping to organize the NETLAKE European citizen science initiative. In which citizens and citizen groups measure water quality parameters in their local lake such as Secchi depth and water colour but also determine decomposition (using tea bags) and sample for microplastics.

Automatic high frequency monitoring for improved lake and reservoir management

Rafael Marcé, Glen George, Paola Buscarinu, Melania Deidda, Julita Dunalska, Elvira de Eyto, Giovanna Flaim, Hans-Peter Grossart, Vera Istvanovics, Mirjana Lenhardt, Enrique Moreno-Ostos, Biel Obrador, Ilia Ostrovsky, Donald C. Pierson, Jan Potužák, Sandra Poikane, Karsten Rinke, Sara Rodríguez-Mozaz, Peter A. Staehr, Kateřina Šumberová, Guido Waajen, Gesa A. Weyhenmeyer, Kathleen C. Weathers, Mark Zion, Bas W. Ibelings, and Eleanor Jennings

Abstract

Recent technological developments have increased the number of variables being monitored in lakes and reservoirs using Automatic High Frequency Monitoring (AHFM). However, design of AHFM systems and posterior data handling and interpretation are currently being developed on a site-by-site and issue-by-issue basis with minimal standardization of protocols or knowledge sharing. As a result, many deployments become short-lived or underutilized, and many new scientific developments that are potentially useful for water management and environmental legislation remain underexplored. This talk bridges scientific uses of AHFM with their applications by providing an overview of the current AHFM capabilities, together with examples of successful applications. We review the use of AHFM for maximizing the provision of ecosystem services supplied by lakes and reservoirs (consumptive and non-consumptive uses, food production, and recreation), and for reporting lake status in the EU Water Framework Directive. We also highlight critical issues to enhance the application of AHFM, and suggest the establishment of appropriate networks to facilitate knowledge sharing and technological transfer between potential users. Finally, we give advice on how modern sensor technology can successfully be applied on a larger scale to the management of lakes and reservoirs, and maximize the ecosystem services they provide.

Rafael Marcé is a research Scientist at the Catalan Institute for Water Research (ICRA) focused on carbon cycling, the detection of the effects of global change on fluvial basins and their ecosystem services, the management of water quality in reservoirs, and the fate of emerging pollutants at the basin scale. He is the leader of the working group on management in NETLAKE.

Informing high frequency dissolved organic carbon monitoring in lakes

Elizabeth Ryder[1], Rafa Marce[2], Florian Poehlein[3], Joan Pere Casas[2], Jonna Kuha[4], Juan Carlos Garcia[5], Don Pierson[6], Eleanor Jennings[1], Kari Austnes[7], Ilga Kokorite[8], Ozgur Avsar[9], Brian MacDomhniall[10], Julian Drupiewski[11], Matthias Koschorreck[3], Karsten Rinke[3] and Stefan Bertilsson[5].

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Abstract

Increases in dissolved organic matter (DOM) concentrations in streams, rivers and lakes in catchments draining peatlands in Europe and North America have been observed in recent decades and may indicate a destabilisation of peatland carbon stores. This increase has major implications for carbon cycling in humic lakes and also for drinking water resources. Treatment of water that is high in DOM poses both health-related and economic problems for water utilities, as these organic compounds react readily with chlorine used for disinfection and form disinfection by-products such as trihalomethanes (THMs). We summarise a set of separate studies focused on DOM which have been undertaken by Working Group 4 in NETLAKE: 1. an assessment of the relationship between dissolved organic carbon (DOC) and light absorbance using data from different European water bodies; 2. an assessment of the applicability of single wavelength pair fluorometers as a proxy for DOM levels at Finnish and Irish sites; 3. the relationship between DOM fractions based on fluorescence and THM formation during water treatment; and 4. an example of the use of high frequency measurements of DOM and THMs at a Spanish reservoir which may have potential as an early warning system for water managers.

Liz Ryder is a research associate and assistant lecturer in Environmental Science in the Department of Applied Sciences, Dundalk Institute of Technology, Ireland. Her main areas of research are carbon cycling in humic lakes, high resolution monitoring of catchment and in-lake processes.

What can high frequency measurements tell us about mixing events in lakes?

I. D. Jones[1], E. B Mackay[1], R. I. Woolway[2], L. Rodriguez[3], M. E. Perga[3], G. Flaim[4], D. Pierson[5] & E. Jennings[6]

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Abstract

The dynamics of lake temperature structure, driven by the interplay of surface wind and heat fluxes, are crucial to many aspects of ecology. It has long been observed that this temperature structure is characterised by an isothermal 'mixed' layer at the top of a lake, varying in depth from centimetres to the full lake depth across different lakes and through different seasons. While the concept of this mixed layer is ubiquitous and the importance of rapid changes in it is acknowledged, there is no unique quantitative definition of a mixing depth or event. This hampers comparisons and also raises questions about definition-dependence of results. Widespread, multi-year, high frequency studies examining mixed depths and mixing events have not previously been possible. The recent proliferation in deployment of high resolution temperature sensors provides an exciting opportunity to compare differences in these physical features across many different lakes at both short and long time-scales to improve understanding of extrinsic and intrinsic drivers of mixing. It also highlights the need to understand the implications of the use of a wide variety of definitions of mixed depth and mixing events. Here we show data from three very different European lakes, to demonstrate the importance of considering the diel cycle in mixing, the large inter-annual variability in mixing and the influence that definition has on the interpretation of mixing. These results provide a starting point for a large-scale analysis of mixing across European lakes.

Ian Jones is a physical limnologist at the UK's Centre for Ecology and Hydrology. He has more than 20 years' experience working in limnology, oceanography and atmospheric science and has been leading UK work on developing and utilising lake monitoring buoys for more than a decade

A European Multi-Lake Survey of Phytoplankton and Cyanobacterial Blooms (EMLS 2015)

Evanthia Mantzouki [1], Bastiaan Ibelings [1],

[1]University of Geneva, Switzerland

Contributors: 147 data collectors and numerous assistants from all over Europe, members of NETLAKE and CyanoCOST.

Abstract

Eutrophication and global warming may further promote harmful algal and cyanobacterial blooms, adding urgency for scientists and lake managers to understand if and how these drivers will interact. CyanoCOST and NETLAKE, two European COST actions working on lakes and reservoirs, joined forces and organized a successful multi-lake survey (EMLS) across wide geographical and climatic regions in Europe in summer 2015. During the EMLS 380 lakes from 32 countries were sampled only once for various physical, chemical and biological parameters. The statistical validity of this snapshot-sampling is based on the large number of lakes included. In order to ensure comparable datasets, representatives of each country gathered for a three-day training school in Evian (France) where they finalized standardized protocols for sampling, sample-processing and various analyses. Each representative went back to their respective countries as EMLS ambassador. Moreover, in Evian we identified dedicated labs in Europe which took responsibility for the analysis of all samples for key variables like HPLC pigments (University of Amsterdam), phytoplankton flowcytometry (University of Geneva), total and dissolved nutrients (University of Wageningen). This is a key step to ensure consistent results among all lakes. At the moment, the various datasets are undergoing quality control to obtain a genuinely integrated dataset which will be openly accessible on GeoNode, an online platform for developing geospatial information, provided by UNEP. Prospects for several publications are currently under discussion while a call for funding contributions allowing the analyses of cyanobacterial toxins and phytoplankton DNA. The first results of the EMLS will be presented.

Evanthia Mantzouki is undertaking a PhD at the University of Geneva. She is a member of Netlake and CyanoCOST action groups.

Lake Heat Flux Analyzer: a program to calculate surface energy fluxes in lakes

R. Iestyn Woolway[1], Ian D. Jones[2], David P. Hamilton[3], Stephen C. Maberly[2], Kohji Muraoka[3], Jordan S. Read[4], Robyn L. Smyth[5], Luke A. Winslow[4].

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Abstract

Lake Heat Flux Analyzer is a program used for calculating the surface energy fluxes in lakes according to established literature methodologies. The program was developed for the rapid analysis of high-frequency data from instrumented lake buoys in support of the emerging field of aquatic sensor network science. To calculate the surface energy fluxes, the program requires a number of input variables, such as air and water temperature, relative humidity, wind speed, and short-wave radiation. Available outputs from Lake Heat Flux Analyzer include the surface fluxes of momentum, sensible heat and latent heat and their corresponding transfer coefficients, and incoming and outgoing long-wave radiation. Lake Heat Flux Analyzer is openly available and can be used to process data from multiple lakes rapidly. The program is written in MATLAB, but users without a MATLAB license can use the online web interface for Lake Heat Flux Analyzer, which runs the program on a remote server based on unique input files and allows users to download the results after completion. Lake Heat Flux Analyzer provides a means of calculating the surface fluxes using a consistent method, thereby facilitating global comparisons of high-frequency lake data.

Iestyn Woolway is a postdoctoral research assistant at the University of Reading (UK), investigating surface temperature changes across all surfaces of Earth, using temperatures retrieved from satellites, measured in situ, and simulated with numerical models. His main research interests are in lakes physics and the interaction of lakes within the climate system and in particular how lakes of all sizes can influence the climate at regional to global scales.

Using high frequency monitoring to manage fishponds in Czechia

Kateřina Šumberová[1], Jan Potužák[1], Markéta Fránková[1], Martina Fabšičová[1], Michal Ducháček[2] & Karel Císař[1]

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Abstract

Fishponds are among the most important water bodies of some parts of Europe. Although they are of anthropogenic origin, designed in particular for common carp breeding, today they are also understood as invaluable cultural heritage and biodiversity hotspots in the landscape. Harmonizing the individual functions of the fishponds is nowadays one of the important tasks for ecologists as well as for fish farmers. Three stations designed for automatic high frequency monitoring (AHFM) of water temperature, dissolved oxygen, photosynthetically active radiation and several meteorological parameters have been established in Dehtář fishpond (South Bohemia, CZ) in the spring of 2014 as a new NETLAKE site. Dehtář is a large slightly hypertrophic fishpond of the size of 238 ha and mean/max depth of 2.6/6 m. Intensive wave action caused by frequent winds is characteristic of this fishpond. Its semi-intensive management involves organic fertilisation and supplementary fish feeding with cereals. Dehtář is drained bi-annually because of the fish harvesting. Thanks to AHFM we detected strong fluctuations in DO, with several day long periods of anoxia over large parts of the fishpond during summer months. These situations occurred after the periods of intensive wave action, leading to further decrease of overall low water transparency and elimination of photosynthesis by microalgae. In the year of lower water level (2015) these situations occurred less frequently. Use of the AHFM may enable the fish farmers to adjust the timing of fish feeding and other management practices according to DO availability, thus avoiding fish mortalities.

Kateřina Šumberová is a botanist and plant ecologist focused on wetland ecosystem biodiversity and functioning, with particular specialisation on fish farming ponds. The framework of her projects' allows her to co-operate with several Czech fish farms.

Assessing the impact of environmental variables together with a short extreme wind event on metabolism Lake Eymir using HF data

Duygu Tolunay[1], Nusret Karakaya[2], Ali Serhan Çağan[1], Rojda Duygu Ögel[2] Fatih Evrendilek[2], Meryem Beklioğlu[1,3*],

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Abstract

A high frequency lake motoring system was used to estimate lake metabolism for Lake Eymir which is located in cold dry step climate of the central Anatolia, Turkey. The system consist of two sondes at 1.5 meter and 4.5 meter, a thermostat chain consisting of 7 thermo-probes through the water column and a meteorological station. In spring, lake metabolisms was autotrophic with positive NEP probably caused by increased chl-a concentration. In summer, the metabolism of Lake Eymir swung between heterotrophy and autotrophy but generally it was heterotrophic with negative NEP. It appears that there was a positive correlation of NEP, GPP and R with TP concentrations. An extreme wind event took placed in autumn which broke up the thermal stratification and mixed the whole water column that led to anoxic conditions leading to a fish kill. Through this mixing event, the NEP estimated from the both of the sonde at 1.5 m and 4.5 m had the closest values and were negative. Thus the whole water column was heterotrophic. The impact of this extreme wind event will be further analyzed and discussed in relation to the environmental factors.

Meryem Beklioğlu is a freshwater ecologist or more precisely a 'shallow laker'. Her research interests include shallow lake ecology, lake restoration, biological interactions with nutrient dynamics and climate biomanipulation using multiple approaches including, monitoring, species for time substitution, paleoecology etc.

Into the future for NETLAKE: the MANTEL MSCA Innovative Training Network and PROGNOS, a WaterJPI project

Eleanor Jennings[1] , Elvira de Eyto[2], Giovanna Flaim[3], Bastiaan Ibelings[4], Ian Jones[5,] Alo Laas[6], Rafael Marce[7], Biel Obrador[8], Don Pierson[9], Lisette de Senerpont Domis[10-11]

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Abstract

A major aim of COST Actions is to foster collaborative projects under EU funded calls. NETLAKE members have been successful in having two projects awarded in recent months. Both focus on key management issues identified in NETLAKE and both include stakeholders as project members. **PROGNOS (2016-2019)** (**Predicting in-lake responses to change using real time models** http://prognoswater.org) will couple high frequency data to water quality models to forecast short-term changes in lake water quality in lakes and reservoirs. It is funded under the EU WaterJPI programme and led by Dr Don Pierson, Uppsala University (Sweden). PROGNOS includes partners in Denmark (Aarhus University), Ireland (Marine Institute/Dundalk Institute of Technology), Israel (Israel Oceanographic and Limnological Research), and Norway (Norwegian Institute for Water Research-NIVA), together with SMEs Utvecklingscentrum för Vatten (Sweden), Bolding & Bruggeman ApS, Luode Consulting (Finland), and Lakeland Instrumentation (UK). The project stakeholders include Irish Water (Ireland), UFZ Magdeburg, the Israeli Water Authority, Oslo Kommune Vann og avløp (the water authority for Oslo, Norway) and Stockholm Water AB. MANTEL (Management of Climatic Extreme Events in Lakes & Reservoirs for the Protection of Ecosystem Services 2017-2020) is a Marie Skłodowska-Curie Actions (MSCA) Innovative Training Network that will investigate the effects of the most extreme climatic events, and cumulative lower magnitude events, using high frequency data from lakes, while at the same time training a cohort of 12 doctoral students in state-of-the art technology, data analysis and modelling. This Joint Doctoral programme will run from January 2017 to December 2020. It is led by Dr Eleanor Jennings (DkIT Ireland) and includes partners in Ireland (Marine Institute), Sweden (Uppsala University), Estonia (Estonian University of Life Sciences), Spain (University of Barcelona and ICRA), Switzerland (University of Geneva), Germany (IGB), Netherlands (NIOO-KNAW and Wageningin), Norway (NIVA), and the UK (CEH). The NETLAKE network will also continue, on a low cost basis, with a three year plan to provide an online platform for those involved in high frequency monitoring in lakes across Europe and one annual meeting, likely collocated with larger events.